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APPLICATION

Of

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For

UNITED STATES LETTERS PATENT

On

Apparatus And Method For Music Production By At Least Two Remotely Located Musicians

Sheets of Drawings: One

TITLE: Apparatus And Method For Music Production By At Least Two Remotely Located Musicians

A previously filed provisional patent application having serial number 60/114,180 and an assigned filing date of 12/30/98 and which contains subject matter similar in concept to that described and claimed in the present application is herein identified.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

This invention relates generally to an apparatus and method for music production by at least two remotely located musicians, and more particularly to a stereo telephone device providing an interactive audio mixing board and expandable bandwidth.

DESCRIPTION OF RELATED ART:

The following art defines the present state of this field:

Brotz et al. US 5,398,278 describes a telephone interface system to interconnect the output of two or more musicians, one at an instant location and the other at a remote location, over communication lines, such system converting the analog musical output to digital form for duplexing over the communication lines.

Nakano, et al. US 5,182,768 describes a digital telephone set connected to a digital data exchange through a transmission line. A plurality of handsets, which are mounted on a telephone body, are for converting input sounds into input analog speech signals and for converting output analog speech signals into output sounds. Connected to the handsets, a plurality of analog-to-digital converters converts the input analog speech signals into input

digital speech signals. Connected to the handsets, a plurality of digital-to-analog converters converts output digital speech signals into the output analog speech signals. On the telephone body are mounted a set of dialing keys for producing a numerical signal. Connected to the dialing keys, a control device is for producing input control data in response to the numerical signal and is for producing an output control signal in response to output control data. Connected to the transmission line, the control device, the analog-to-digital converters, and the digital-to-analog converters, a multiplexing/demultiplexing circuit is for transmitting/receiving transmission/reception time division multiplexed signals to/from the digital data exchange through the transmission line. The multiplexing/demultiplexing circuit is for multiplexing the input digital speech signals and the input control data into the transmission time division multiplexed signal and for demultiplexing the reception time division multiplexed signal into the output digital speech signals and the output control data.

Brotz , et al. US 5,020,101 describes a musician's telephone interface that interconnects an instant location through a telephone line to a remote location such device having inputs to receive the sound from musical instruments and/or vocalization at each location with balancing circuitry and broadcast means at each location for the musicians at each location to hear the music of one another simultaneously balanced for collaboration and production of music.

Hoque, et al. US 4,922,536 describes in-studio, stage or field applications, high fidelity audio signals are transmitted to a remote processor in digital form in order to solve the problems of audio degradation, cross talk, ground loops and multi-cable problems associated with the analog transmission of multiple channels of audio over long distances. In one embodiment a TDM/FDM multiplexing system is utilized with increased bandwidth and dynamic range compared to data and telephone multiplexing systems to accommodate high fidelity requirements. In an embodiment involving a distributed system, multiple MUX and DEMUX modules are coupled in a distributive fashion along a light-weight transmission

line, in which each of the modules is assigned a predetermined transmission frequency and with each of the modules having a number of audio inputs which are time-multiplexed for that particular MUX module and frequency. The Subject System precludes the necessity of running multiple audio cables to remote destinations, while at the same time providing an exceptionally quiet system, since the digital data stream is extremely tolerant to cross talk, ground loops, noise, signal attenuation, and non-linearity associated with conventional analog audio transmission.

The prior art teaches various apparatuses which convert analog signals to digital and the reverse, as well as allowing multiplexing over phone lines. The prior art also teaches a multiplexing system with increased bandwidth and dynamic range, where a transmission occurs over lightweight coaxial cable, or fiberoptic or twisted-pair cable . However, the prior art does not teach an invention and method that allows transmission of signals between local and remote musicians where the transmission occurs over standard phone lines with a bandwidth of up to 20 kHz, which is nearly seven times that enabled by prior art technology. The present invention fulfills these needs and provides further related advantages as described in the following summary.

SUMMARY OF THE INVENTION

The present invention teaches certain benefits in construction and use which give rise to the objectives described below. A local and remote sites are joined by one or two telephone lines so that both monaural as well as stereo signals may be transmitted between the two sites and combined by adjusting level and delay to synch the signals as if produced at either site. The upper and lower frequencies that are not easily passed by copper telephone transmission lines are adjusted in frequency and multiplexed for transmission.

The remote site is constructed similarly to the local site so that the signal of remote origin is transmitted to the local site in the same manner. The remote signal is transmitted over the same phone line if it is duplexed, or over a separate phone line for improved signal integrity, better separation and improved fidelity, i.e., signal carrying capacity.

The remote origin signal is received by a local demultiplexer circuit which establishes the three signals representing the low, mid and high range of the remote sourced signal. The mid range portion is directed to the local mixer circuit while the low range portion is demodulated and the high range portion is frequency multiplied by an order of magnitude in the reverse processes as described above. The remote low and high pass portions are directed to the mixer circuit. The mixer circuit combines all three of the remote signal portions and adjusts their level or volume as well as establishing a time delay in the local signal so that both the local signal and the remote signal are in time synch. The local and the remote sourced signal are then directed to a monitor such as a video screen or to a loudspeaker.

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The same signal processing is conducted at the remote site so that the remote musician(s) are able to enjoy the local music portion and maintain synchronization.

In a first embodiment, the local signal is transmitted on the first phone line while the remote signal is transmitted on the second phone line. In a second embodiment of the present invention, the left channel of a stereo local and remote signals are transmitted over the first phone line while the right channel is transmitted over the second phone line. In a third embodiment, portions of both local and remotely derived signals are sent over one phone line which the complementary portions of the signals are transmitted over the other phone line. For example, the low pass of the local signal and the mid and high pass of the remote signal may be transmitted over the first line, while the mid and high pass of the local signal and the low pass of the remote signal is transmitted over the second line.

While the invention has been described with reference to at least one preferred embodiment, it is to be clearly understood by those skilled in the art that the invention is not limited thereto. Rather, the scope of the invention is to be interpreted only in conjunction with the appended claims.

A primary objective of the present invention is to provide an apparatus and method for music production by at least two remotely located musicians having advantages not taught by the prior art.

Another objective is to provide such a device and method of use able to be utilized by musicians using coventional phone lines..

A further objective is to provide such an apparatus and method of use which allows a signal of up to 20 kHz bandwidth – nearly seven times more than the current state of the art -- to be conveyed over two phone lines.

A still further objective is to provide such an apparatus and method of use that allows conference calling capabilities between local and remote musicians at two or more locations.

A still further objective is to provide such an apparatus and method of use that provides for signal delay control, so as to provide synchronization in time between the output and input signals. The signal passes out to the remotely located musician(s) who are able to hear it contemporaneously with its being produced, despite the time difference that may exist between the local musicians and the remotely located musicians.

Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing illustrates the present invention wherein FIGURE 1 is a schematic diagram of a local site of the preferred embodiment of the present invention, wherein a remote site is constructed identically.

DETAILED DESCRIPTION OF THE INVENTION

The above described drawing figure illustrates the invention, an apparatus for music production by at least one local and at least one remotely located musician so that they can produce a jointly and combined music signal which seems to come from a common source although the local and remote musicians may be separated by a large distance. A local music signal is produced by one or more local musicians or music sources of any kind and conducted for processing to a local signal mixing element as is well known. At the same time, a telephone line transmits a midrange frequency portion of the local music signal to a remote location. The midrange portion of the signal is considered to have a bandpass of 300 to 3,000 Hz which a standard copper phone line will pass without attenuation. However, the low pass range: 20 Hz to 300 Hz, and the high pass range: 3,000 Hz to 20,000 Hz of the music signal are greatly attenuated by the standard phone line so that these portions of the signal are not transmitted directly. Music is considered to present full fidelity if all frequencies from 20 Hz to 20,000 Hz are present at full amplitude.

It is desired to send the low and high bands to the remote site over the phone line along with the midrange, and without attenuation.

As shown in Fig. 1 the low and high portions of the local signal are selected by low and high bandpass filters respectively. The low pass portion of the signal is frequency shifted by a standard frequency shifting circuit (modulator) as is well known to those of skill in the art, to a range of from 2,250 Hz to 3,000 Hz. The high pass portion of the signal is frequency divided by an order of magnitude to a range of from 300 Hz to 2,000 Hz. The low, mid and high ranges of the signal are then multiplexed and transmitted on a first phone line.

If the signals are split into left and right stereo portions, they are treated in the same manner over two channels simultaneously.